Datorkommunikation och nätverk för civilingenjörer

VT20, DT503G

Örebro Universitet

First exam, June 4th, 2020

Instructors:

Oscar Martinez Mozos (telephone 019 301017)

Jasmin Grosinger (telephone 019 301346)

Zoom:

Zoom link: **https://oru-se.zoom.us/j/4207485391**

Zoom phone: +46 850 539 728 (meeting ID: 420 748 5391)

Exam details:

Number of exercises: 8

Total points: 100

Exam time: 14:15 to 18:15 (4 hours)

Grading:

fail corresponds to **less than 50** points

3 corresponds to **50** to 69 points

4 corresponds to **70** to 84 points

5 corresponds to **85** or more points

Instructions:

- Each question indicates the points awarded when the **answer is fully correct**.
- All exercises must be solved **individually**, no group work allowed.
- You may use books and other sources, but **you may not cooperate or ask anyone** (except the teacher). For example, you are allowed to search the Internet, but not to ask questions on the Internet.
- **You must clearly refer** to all sources used to solve an exercise (books, lectures, Internet pages, etc) so the examiner can easily find them. Any sign indicating that you have breached the above rules may lead to a case being **reported to the disciplinary office**.
- Write your solution using the word-processor of your choice, **save it in PDF format** and upload the PDF.
- You can also write your solution on paper (with clear handwriting), **scan it in PDF** format and upload the PDF. If you need to draw a diagram, scheme, etc. you can do it by hand and **include a photo of it in the document** or upload it as an attachment.
- If a question or exercise looks unclear to you, then make reasonable assumptions and write them down.
- **Write explanations** of how you thought. Even a wrong answer can give you points if you show that your thoughts were right. Please, use **short and complete sentences**.
- Please, answer **in English**, we do not evaluate your level of English.
- The **instructors are available** for clarifications from 15:00 to 17:00 on Zoom:
  Zoom link: **https://oru-se.zoom.us/j/4207485391**
  Zoom phone: +46 850 539 728 (meeting ID: 420 748 5391)

Question 1 - 12pts

Assume you are inside the Örebro University network. You open a browser and type:

http://blabla.com/index.html

in the address bar.

Explain briefly (no more than half a page) what happens until the webpage is displayed. Indicate the protocol(s) used, a high level description of the messages exchanged, and the potential use of external servers that are contacted when needed (e.g. DNS servers, cache servers, etc.).

Question 2 - 10pts

One computer acting as client sends the following 32 bits to a server using UDP:

0010100010101101 1001101001111001

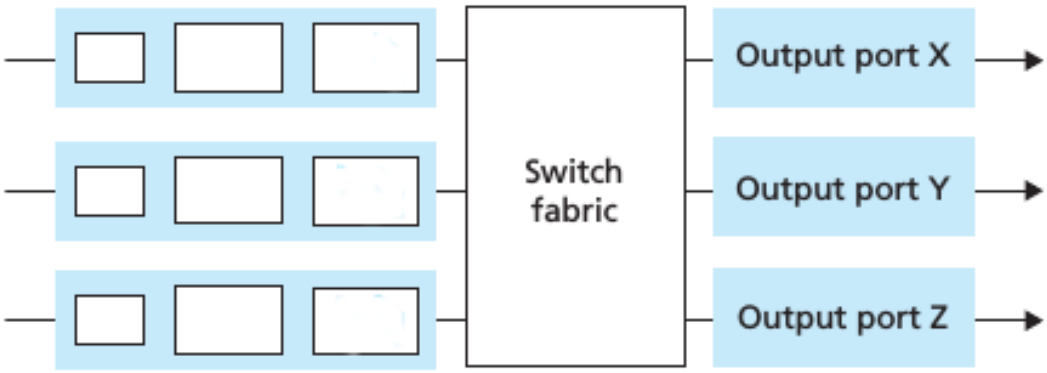
The server receives the the following string:

0010100010101101 1001101001111001

Show the steps taken by the client and the server to create a 16 bits checksum code and to check the integrity of the data (whether there is an error or not).

Question 3 - 15pts

Consider the router shown below. Suppose that all datagrams have the same fixed length, that the switch operates in a slotted, synchronous manner, and that in one time slot a datagram can be transferred from an input port to an output port. The switch fabric is a crossbar so that at most one datagram can be transferred to a given output port in a time slot, but different output ports can receive datagrams from different input ports in a single time slot.



a) Draw five packets in the router schema marked with the output port they should be sent to. Draw the packets such that one of the packets experiences Head-of-the-line (**HOL**) blocking and mark clearly the HOL-blocked packet. Why/How is it blocked? Explain shortly HOL.

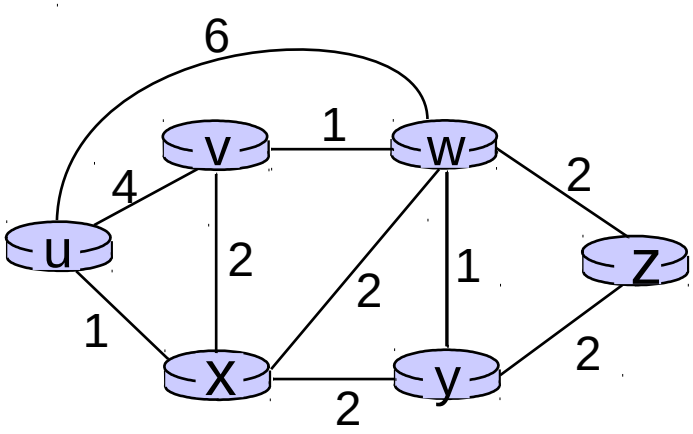
b) What is the minimal number of time slots needed to transfer the packets that you drew in a) from input ports to their output ports, assuming RR input queue scheduling? Describe which packets are sent in each time slot.

c) Can you think of a scenario where a packet is HOL-blocked multiple times? Give an example configuration. Use any number of packets that you choose yourself.

Question 4 - 18pts

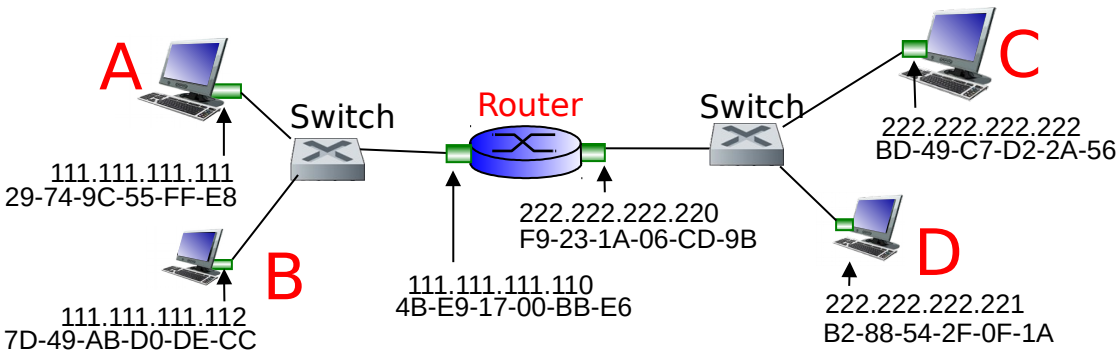
Calculate the forwarding table for node **u** using Dijstra algorithm. Indicate the steps following this table:

Step	N'	D(v), p(v)	D(w), p(w)	D(x), p(x)	D(y), p(y)	D(z), p(z)
0	u					



Question 5 - 10pts

Check the following figure for a configuration of a small network with 2 subnetworks separated by a router:



Host A wants to send a datagram to host C.:

a) Complete the fields in the link level datagram sent by host A :
IP source:
IP destination:
MAC source:
MAC destination:

b) The datagram reaches the router. Complete the fields of the link level datagram sent by the router in order to reach destination host A. Assume the router knows the MAC address of host C:
IP source:
IP destination:
MAC source:
MAC destination:

c) Imagine the situation where host A does not know the MAC address of the corresponding interface in the router. How can host A get the MAC address of the corresponding interface in the router?

Question 6 - 10pts

In wireless networks:

1) Explain the hidden terminal problem.

2) Explain the fading problem.

Question 7 - 18pts

Suppose Alice wants to securely send message *m* to Bob. We have the following requirements:

a) Make the message confidential.
b) Authenticate Alice.
c) Proof the message is actually from Alice.
d) Make sure the message is not altered.

For each requirement a)-d), present a possible solution and use it on the message m to make it secure for transmission. Explain what you are doing.

NOTE: It is enough to indicate formulas. You do not need to do calculations with actual numbers.

Question 8 - 7pts

The diagram of the client-server application used for DNS request and respond is shown below.

(1) What transport layer is used for this application?

(2) Please point out which variable indicates the used protocol when the socket is initialized.